

REMARKS

The above-identified application has been carefully reviewed in light of the Office Action mailed May 28, 2008. Enclosed is a Request for Extension of Time, and required fee, extending the period for responding to the Office Action to and including October 28, 2008.

Applicant gratefully acknowledges the Examiner's holding that claim 36 is allowed and that claim 38 includes allowable subject matter.

Without conceding the correctness of any of the Examiner's objections or rejections, applicant has amended the present claims to facilitate prosecution of the above-identified application to obtain an early allowance. Applicant expressly reserves the right to seek patent protection for the previous claims and for any other claims supported by the above-identified application in one or more related applications.

Specifically, claim 6 has been amended to correct a minor typographical error so that the claim reads more clearly. Claim 10 has been amended to include the subject matter of claim 11. Claim 12 has been amended to include the subject matter of claim 13. Claim 14 has been amended to further comprise an alternate means for providing a vacuum on a face of the membrane remote from the gas stream. Claims 15 and 35 have been amended to read more clearly. Claim 37 has been amended to include the subject matter of claim 38. New claims 40 to 52 have been added and are directed to embodiments for which patent protection is sought. Claims 2, 3, 5, 7-9, 11, 13, 16-26 and 38 have been cancelled, without prejudice.

Support for each of these amendments is set forth in the present specification. Such support is present in the specification at, for example, page 5, lines 31-34 (claims 14, 42, 45 and 51); page 3, lines 25-30 (claims 40 and 49); page 5, lines 10-13 (claims 41, 44 and 50); page 6, lines 21-26 (claims 43, 46 and 52); and page 4, lines 16-19 (claims 47 and 48).

Therefore, applicant submits that the claims, including the amended claims and the new claims, include no new matter.

In view of the cancellation of claim 22, applicant submits that the objection to this claim under 37 CFR 1.75(c) is moot. Therefore, applicant respectfully requests that this objection be withdrawn.

Claims 1-3, 6, 10, 12-14 and 35 have been rejected under 35 U.S.C. 102(b) as being anticipated by Steinwandel et al (U.S. Patent 5,876,486). Applicant traverses this rejection as it pertains to the present claims, and in particular to claims 1, 6, 10, 12, 14 and 35, as well as to new claims 47-52.

As set forth in independent claim 1, the present invention is directed to apparatus for separating CO<sub>2</sub> from a gas stream containing CO<sub>2</sub> and an anaesthetic gas. The apparatus comprises a gas separation device and means for transporting the gas stream at a periodically varying flow rate, for example, a sinusoidally varying flow rate (independent claim 47), through the gas separation device. The device comprises a supported carrier liquid membrane in which the carrier species is an organic base present at a concentration to provide a separation factor  $\alpha$  (CO<sub>2</sub> a),

$$\text{where } \alpha (\text{CO}_2, a) = \frac{R_{\text{CO}_2}}{P_{\text{CO}_2}} \cdot \frac{P_a}{R_a}$$

wherein R represents permeation rate, p partial pressure of a gas in the feed gas stream and a an anaesthetic gas, greater than unity.

As set forth in the present specification, starting at page 2, line 18, the present invention is based on the observation that a supported liquid membrane removes CO<sub>2</sub> from a gas stream also containing an anaesthetic at an acceptable separation factor, as defined in the present claims, greater than unity when the gas stream is one in which substantial variation occurs periodically, for example, sinusoidally, in the flow rate.

See page 2, lines 9-17 of the present specification, which discusses the problems faced in removing CO<sub>2</sub> from a gas stream in which variations in flow rate occur.

The finding that an acceptable separation factor, as noted above, is obtained in accordance with the present invention even when transporting the gas stream at a periodically, for example, a sinusoidally, varying flow rate, is unexpected and unpredictable and is an important and advantageous aspect of the present invention.

Steinwandel et al discloses an apparatus and method for continuously removing metabolically produced carbon dioxide from respired air using two sets of hollow fibers disposed in a flowing, carbon dioxide-selective liquid membrane. Steinwandel et al discloses, as column 5, lines 47-54, that cabin air is circulated through the feed side hollow fibers in the membranes step by using a blower, and that the pressure loss in the fibers is determined by the cross-section and the length of the hollow

fibers as well as by the nature of the gas flow (steady or turbulent). Further, Steinwandel et al discloses, at column 6, line 46-47, the difference between the carbon dioxide feed pressure and the carbon dioxide permeate pressure.

Steinwandel et al does not disclose, teach or suggest the present invention. For example, Steinwandel et al does not disclose, teach or suggest an apparatus for separating CO<sub>2</sub> from a gas stream containing CO<sub>2</sub> and an anaesthetic gas which comprises a gas separation device and means for transporting the gas stream at a periodically varying, for example, a sinusoidally varying, flow rate through the gas separation device, as recited in the present independent claims 1 and 47. More specifically, Steinwandel et al does not disclose, teach or even suggest that the speed of the blower disclosed in Steinwandel et al can be adjusted or varied. Importantly, Steinwandel et al includes no disclosure, teaching or suggestion of any mechanism by which the speed of the blower can be adjusted or varied in such a way as to transport the gas stream at a periodically varying flow rate, for example, a sinusoidally varying flow rate, through the gas separation device.

The Examiner appears to be assuming that the blower disclosed in Steinwandel et al can have its speed adjusted. However, Steinwandel et al provides no basis for such an assumption. In short, applicant submits that the Examiner has no basis whatsoever for the above-noted assumption. Moreover, the Examiner is not entitled to interpret the prior art to include features which are not present in the prior art.

The apparatus of independent claims 1 and 47, which include means for transporting the gas stream at a periodically or

sinusoidally (claim 47) varying flow rate are not disclosed in or even suggested by Steinwandel et al. Therefore, applicant submits that independent claim 1, and the claims dependent upon claim 1, and independent claim 47, and the claims dependent on claim 47, are novel over and not anticipated by Steinwandel et al under 35 U.S.C. 102(b).

In addition, these claims are not obvious over Steinwandel et al under 35 U.S.C. 103. For example, Steinwandel does not disclose, teach or even suggest apparatus for separating CO<sub>2</sub> from a gas stream containing CO<sub>2</sub> and an anaesthetic gas in which the device includes means for transporting the gas stream at a periodically, for example, sinusoidally, varying flow rate through the gas separation device. Many of the same arguments made with regard to the novelty of the present claims over Steinwandel et al apply in equal measure with regard to the obviousness of the present claims over Steinwandel et al and, as such, are resubmitted here. In addition, the important and advantageous findings of applicant, and applicant alone, that an effective separation factor of greater than unity is obtained even using means for transporting the gas stream at a periodically, e.g. sinusoidally, varying flow rate through the gas separation device, as recited in the present claims, is not disclosed, taught or even suggested by Steinwandel et al.

In addition, the Examiner has already determined that the method of claim 36 is patentable. Until the present inventors conceived of the method, as claimed in claim 36, the person of ordinary skill in the art would have had no incentive to even consider adapting and extending Steinwandel et al to incorporate means or transporting the gas stream at a periodically or

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sinusoidally varying flow rate, which is expressly stated in method claim 36 and apparatus claims 1 and 47.

In view of the above, applicant submits that independent claims 1 and 47, and the claims dependent thereon, are unobvious from and patentable over Steinwandel et al under 35 U.S.C. 103.

Since claims 16-18 and 22-26 have been cancelled, without prejudice, applicant submits that the rejection of these claims under 35 U.S.C. 102(b) as being anticipated by Jansen et al (U.S. Patent 5,749,941) is moot. Therefore, applicant respectfully requests that this rejection be withdrawn.

In addition, since claim 37 has been amended to include the subject matter of allowable claim 38, applicant submits that the rejection of claim 37 under 35 U.S.C. 102(b) as being anticipated by Jansen et al is moot. Therefore, applicant respectfully requests that this rejection be withdrawn.

Claims 4, 5 and 11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Steinwandel et al in view of Jansen et al. Applicant traverses this rejection as it pertains to the present claims.

The disclosure and deficiencies of Steinwandel et al have been discussed previously and are resubmitted here.

Jansen et al discloses providing various liquid phases which absorb gaseous components to be removed from a gas phase in a membrane system and which produce no leakage from the membrane or are effective in preventing leakage from the membrane.

The Examiner contends that Jansen et al discloses that the carrier is present in a concentration of 5 mol/L, at column 5, lines 62 to column 8, line 20 of Jansen et al.

Jansen et al does not disclose, teach or suggest the present invention. For example, Jansen et al does not disclose, teach or even suggest an apparatus for separating CO<sub>2</sub> from a gas stream containing CO<sub>2</sub> and an anaesthetic gas with the apparatus comprising a gas separation device and means for transporting the gas stream at a periodically, for example, sinusoidally, varying flow rate through the gas separation device in which the device comprises a supported carrier liquid membrane in which the carrier is present in a concentration of at least 4.5 mol.dm<sup>-3</sup>, as recited in claim 4, or in which the membrane support is a porous polymer selected from the group consisting of polysulfone and polyacrylonitrile, as recited in claim 10 (which includes the subject matter of previous claim 11).

Jansen et al, like Steinwandel et al, does not disclose, teach or even suggest means for transporting a gas stream at a periodically, for example, sinusoidally, varying flow rate through the gas separation device, as recited in the present claims. Therefore, applicant submits that Jansen et al does not supply the deficiencies apparent in the teachings of Steinwandel et al.

In view of the above, applicant submits that the present claims, and in particular, claims 4, 5 and 10, as well as new claims 40-52, are unobvious from and patentable over Steinwandel et al in view of Jansen et al under 35 U.S.C. 103(a).

Claim 15 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Steinwandel in view of Sirkar et al (U.S. Patent 6,635,103). Applicant traverses this rejection.

Claim 15 is a claim indirectly dependent upon claim 1.

The disclosure and deficiencies of Steinwandel et al have been discussed previously and such discussion is resubmitted here.

Sirkar et al discloses a method for the separation of carbon dioxide that uses an immobilized liquid membrane containing a dendrimer and, optionally, at least one solvent having carbon dioxide selectivity, such as glycerol, polyethylene glycol, water, refrigerated methanol, NMP, or glycerol carbonate. In another embodiment, Sirkar et al discloses that the method involves using a dendrimer selective for carbon dioxide and capable of forming a film as the membrane itself, optionally with at least one solvent.

Neither Sirkar et al nor Steinwandel et al disclose, teach or even suggest the present apparatus for separating CO<sub>2</sub> from a gas stream containing CO<sub>2</sub> and an anaesthetic gas which apparatus comprises a gas separation device and means for transporting the gas stream at a periodically, for example, sinusoidally, varying flow rate through the gas separation device, as recited in the present claims.

In view of the above, applicant submits that the present claims, in particular claim 15 and new claims 40-52, are unobvious from and patentable over Steinwandel et al in view of Sirkar et al under 35 U.S.C. 103(a).

Claims 37 and 39 have been rejected under 35 U.S.C. 103 as being unpatentable over Steinwandel et al in view of Jansen et al.

Claim 37 has been amended to include the subject matter of claim 38, which the Examiner has indicated includes allowable subject matter. Claim 39 is dependent upon claim 37.

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Therefore, applicant submits that the rejection of claims 37 and 39 under 35 U.S.C. 103 is moot and respectfully requests that this rejection be withdrawn.

Each of the present dependent claims is separately patentable over the prior art. For example, none of the prior art, taken singly or in any combination, disclose, teach or even suggest the present apparatus and methods including the additional feature or features recited in each of the present dependent claims. Therefore, applicant submits that each of the present claims is separately patentable over the prior art.

In conclusion, applicant has shown that the present claims are not anticipated by the prior art and are unobvious from and patentable over the prior art under 35 U.S.C. 102 and 103. Thus, the present claims, that is claims 1, 4, 6, 10, 12, 14, 15, 35-37 and 39-52 are allowable. Therefore, applicant respectfully requests the Examiner to pass the above-identified application to issuance at an early date. Should any matters remain unresolved, the Examiner is requested to call applicant's attorney at the telephone number given below.

Respectfully submitted,



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